Space Weather Technical Forecast

Issued on Monday, 26 September 2022 at 01:10 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of G1 Day 1 (26th) due to possible CME influence. Daily Chance of R1 Minor Radio Blackouts throughout.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity, as measured by GOES-16 and 17 satellites, has been Low with further C-class flares, largely from AR3107 and AR3110 which are both located on the eastern side of the visible disc. The largest event peaked at C6 at 25/0706 UTC from AR3110.

There are currently five numbered active regions on the visible disc. The largest region, currently AR3110 (Eso/Beta) in the northeast quadrant, has shown consolidation in its intermediate spots, and along with AR3107 (Eai/Beta) in the southeast, have both generated most of the recent C-class flares. AR3105 in the south, near the central meridian, continues to decay. Remaining regions are largely benign and showing decay. The previously small un-numbered group has now faded.

Previously analysed CMEs from 21st and 22nd may give some glancing influence at Earth early on day 1 (26th), however confidence is low, and there remains a possibility of a later arrival on day 2 (27th). No other Earth directed CMEs have been observed in recent imagery.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR and ACE at L1, has shown a gradual decline from slightly elevated to background levels, 410km/s to 300km/s. The solar wind density was mostly below average, with steady rise towards average by the end often period. The IMF was Weak, varying between 2nT and 7nT. The north-south component, Bz, was also at Weak, fluctuating between +2nT and -4nT, and was often negative (southward). The phi angle was largely in the positive (away from the Sun) solar sector. Geomagnetic activity was Quiet to Unsettled (Kp 1 to 3).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES16, remained very close to Background levels. High energy electron flux (greater than 2 MeV) was at background to Moderate levels, increasing to High levels, with a peak value of 2130 pfu at 25/1555 UTC, before declining back to Moderate levels. The associated 24-hour fluence remained well below the Active (1e8 integrated pfu) threshold, although with a rising trend. Observed fluence at 26/0000UTC was 5.43e7 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is forecast to be generally Low, with a daily Chance of isolated M-class flares. The main flare risk remains from AR3110 and AR3107 on the eastern side of the disc.

Solar Wind / Geomagnetic Activity: This forecast period comprises of two low confidence CMEs potentially arriving on day 1 (26th), and perhaps some limited coronal hole influence from CH26/- later in the period.

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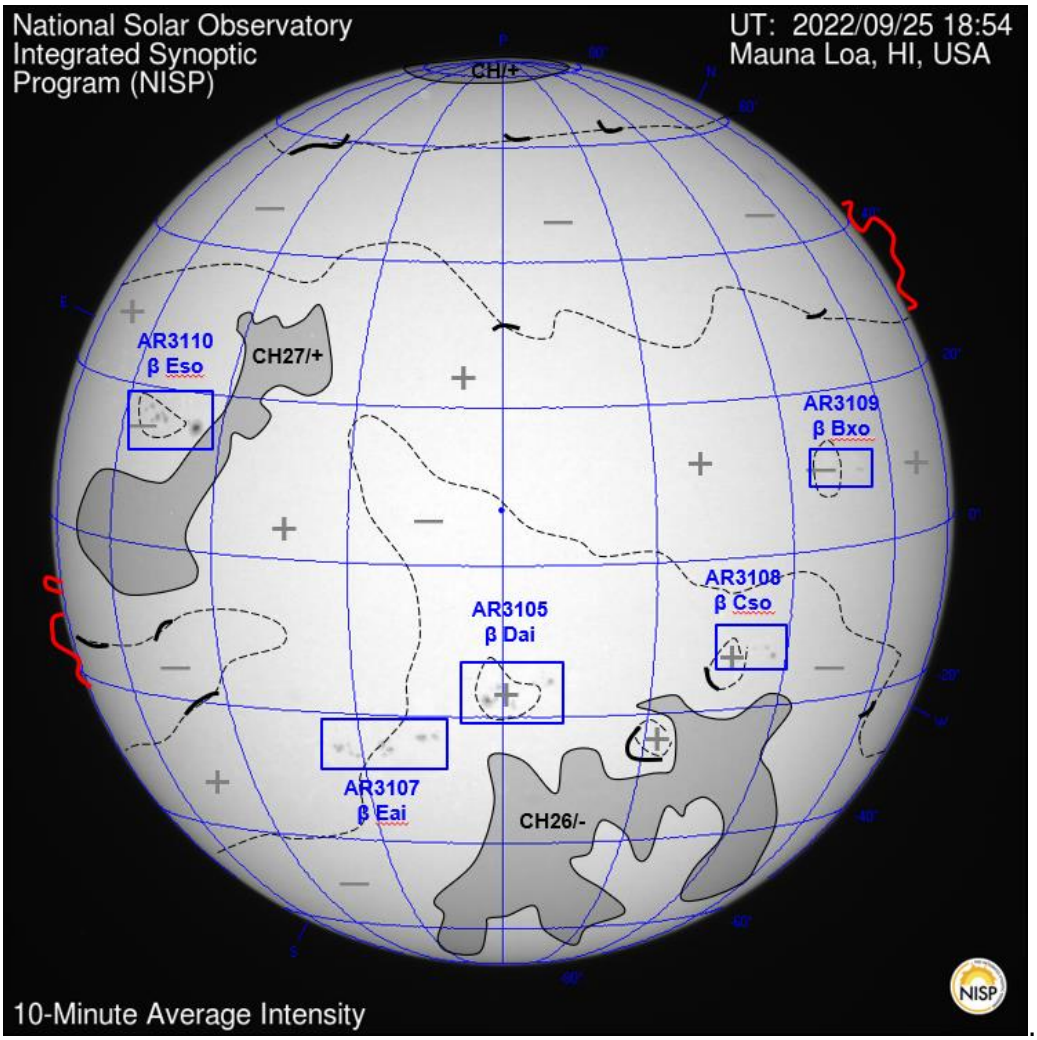
Solar winds have gently decreased and are now settled at background levels, following the recent influence from CH25/+. A potential enhancement may occur early on day 1 (26th) from possible glancing CME influences, with a 30% chance of G1 intervals. Any potential influence from CH26/- later in the period is most likely to be limited in impacts, with G1 currently assessed as being unlikely. In summary, geomagnetic activity is likely to remain mostly below G1 level throughout the period.

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES16, is expected to persist at Background levels.

The high energy electron flux (greater than 2 MeV) is expected to be mostly at Background to Moderate levels, with a chance of reaching High levels during the diurnal peaks over the next day or two. Confidence in the forecast is lowered due to possible glancing CME influence likely during day 1 (26th). However, the associated 24-hour fluence is expected to stay below the Active (1e8 integrated pfu) threshold through the period, albeit with an initial rising trend.

Figure 1. Solar Analysis Valid 25/1854 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

This forecast period comprises of two low confidence CMEs potentially arriving on day 1 (26th), and perhaps some limited coronal hole influence from CH26/- later in the period.

Solar winds have gently decreased and are now settled at background levels, following the recent influence from CH25/+. A potential enhancement may occur on day 1 (26th) from possible glancing CME influences, with a 30% chance of G1 intervals. Any potential influence from CH26/- later in the period is most likely to be limited in impacts, with G1 currently assessed as being unlikely. In summary, geomagnetic activity is likely to remain mostly below G1 level through the period.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	30	10	10	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
22/0532	Partial	C-class flare perhaps AR3105	SE	309	Late 25 Sep or into 26 Sep	Source uncertain, very low confidence. Probably independent from CME below
22/2058	Partial	AR3109	Centre NW disc	400	26 Sep possibly 27 Sep	Low confidence. Mainly N and W of SunEarth line.

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Radio Blackouts - X-Ray Flares:
Solar activity has been Low with further C-class flares, largely from AR3107 and AR3110, which are both located on the eastern side of the visible disc.

There are currently five numbered active regions on the visible disc. The largest, currently AR3110 (Eso/Beta) in the northeast quadrant, has shown consolidation in its intermediate spot, and along with AR3107 (Eai/Beta Gamma) in the southeast, are both generating most of the C-class flares. AR3105, in the south hemisphere, near centre meridian, is showing further slow decay. Remaining regions are largely benign and showing decay.

Several possible returning regions may transit to, or over the east limb over the next few days. Generally Low levels of solar activity are forecast, with a daily Chance of isolated M-class flares.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	40	40	40	40
Very Active	R3 to R5 X Class	No	5	5	5	5

Figure 2: GOES 16 X-Ray flares

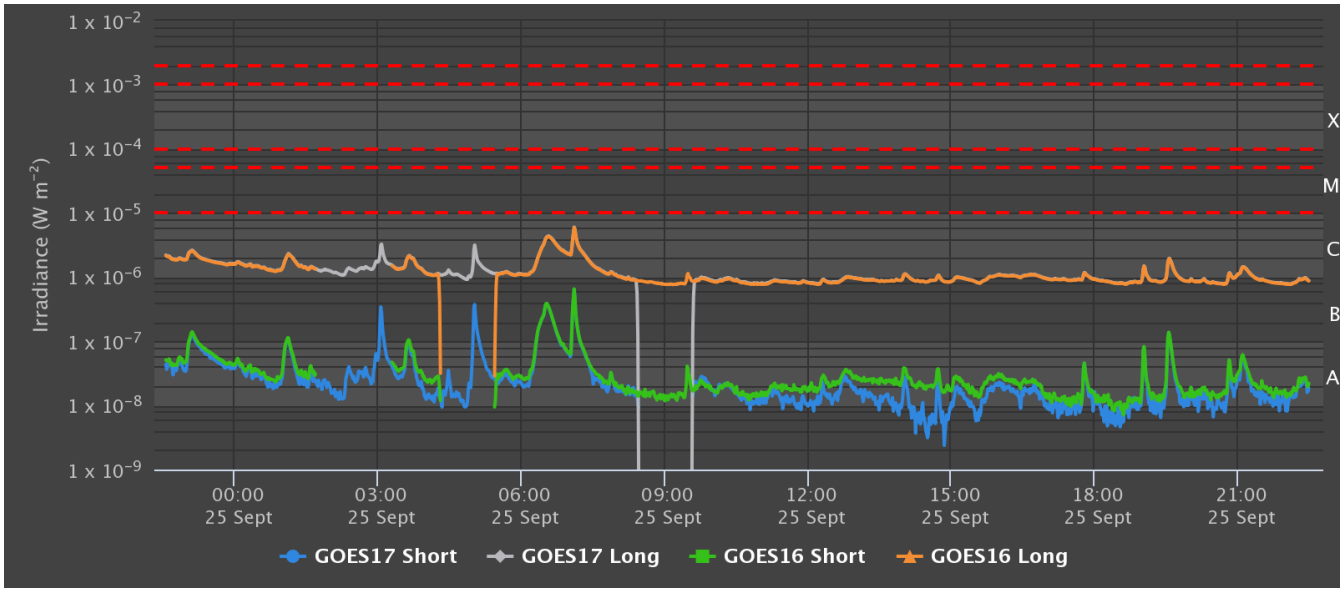

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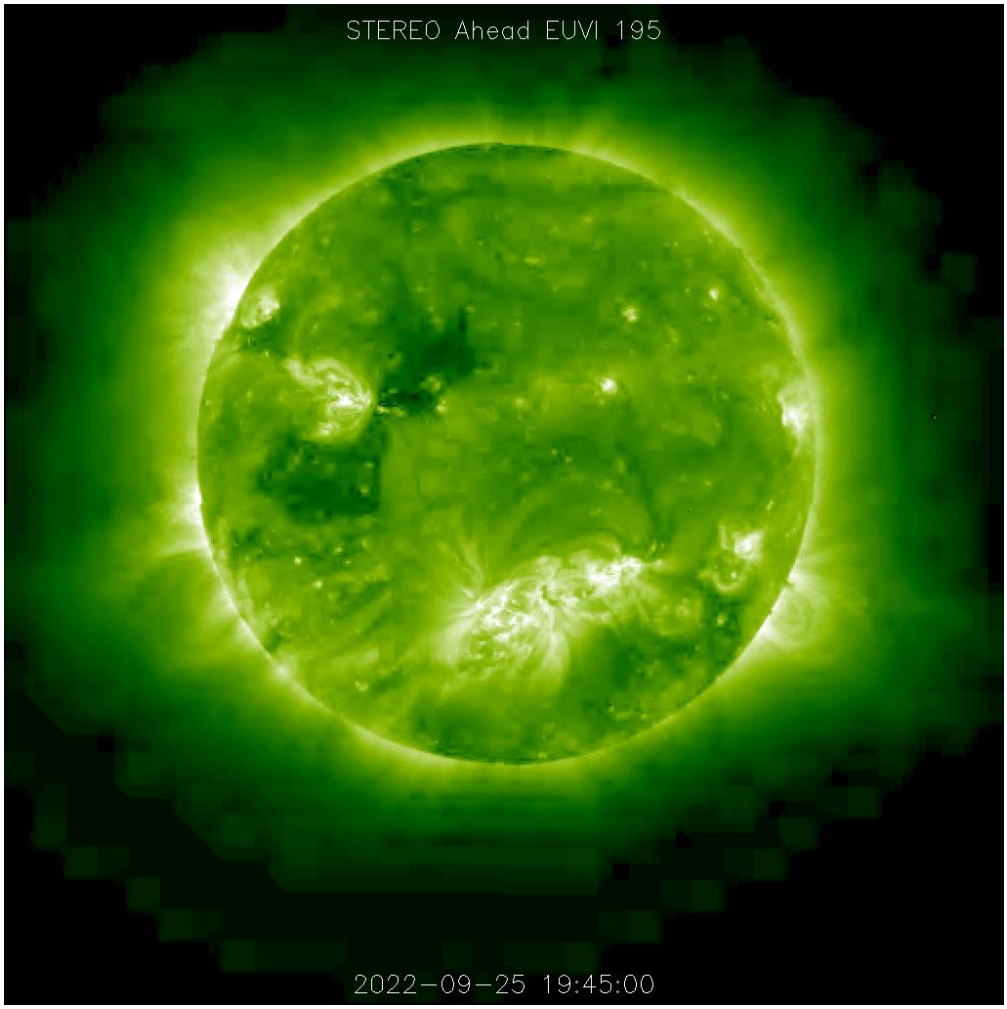
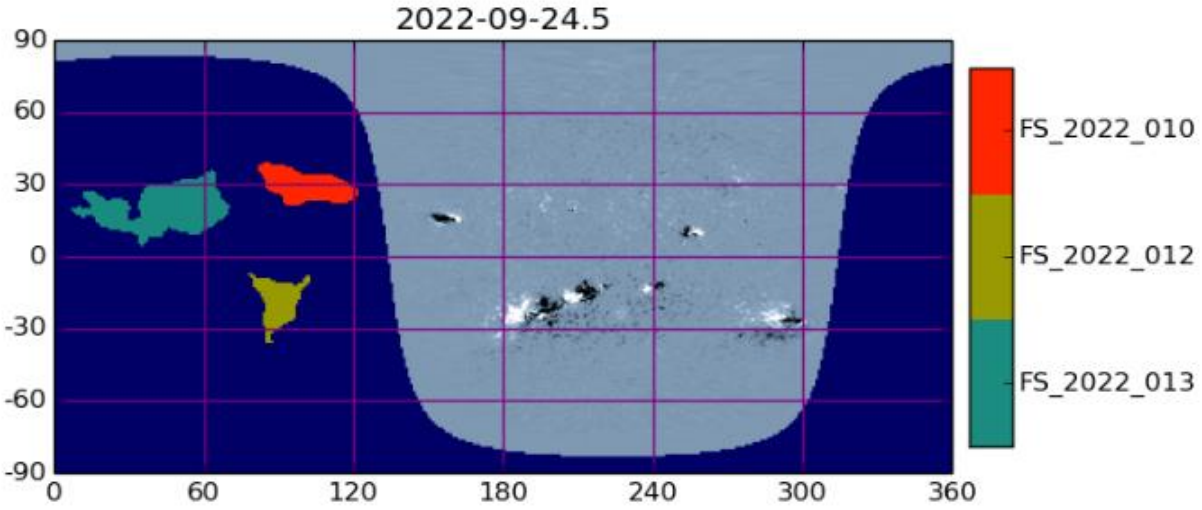
Figure 3: STEREO-A EUVI (top) showing potential bright flux regions approaching the east limb, which is also evident in the seismicgraph from Stanford (bottom), suggesting regions are due to rotate around the east limb in the coming days.





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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10MeV) observed by GOES16 is expected to remain at or very close to Background levels.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2 MeV) as observed by GOES16, has declined from High to Moderate levels.

Following the recent coronal hole influence of CH25/+ electron populations in Earth's Van Allen belts have risen a little, with High flux levels perhaps developing during the diurnal maximum during day 1 (26th). Confidence in the forecast is low due to a possible glancing CME influence.

The associated 24-hour fluence is expected to stay below the Active (1e8 integrated pfu) threshold through the period, although with an initial rising trend, and this is reflected in the probability figures given in the table above. MOSWOC REFM looks to be giving reasonable guidance in the coming few days and is tentatively accepted.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	30	20	20	20
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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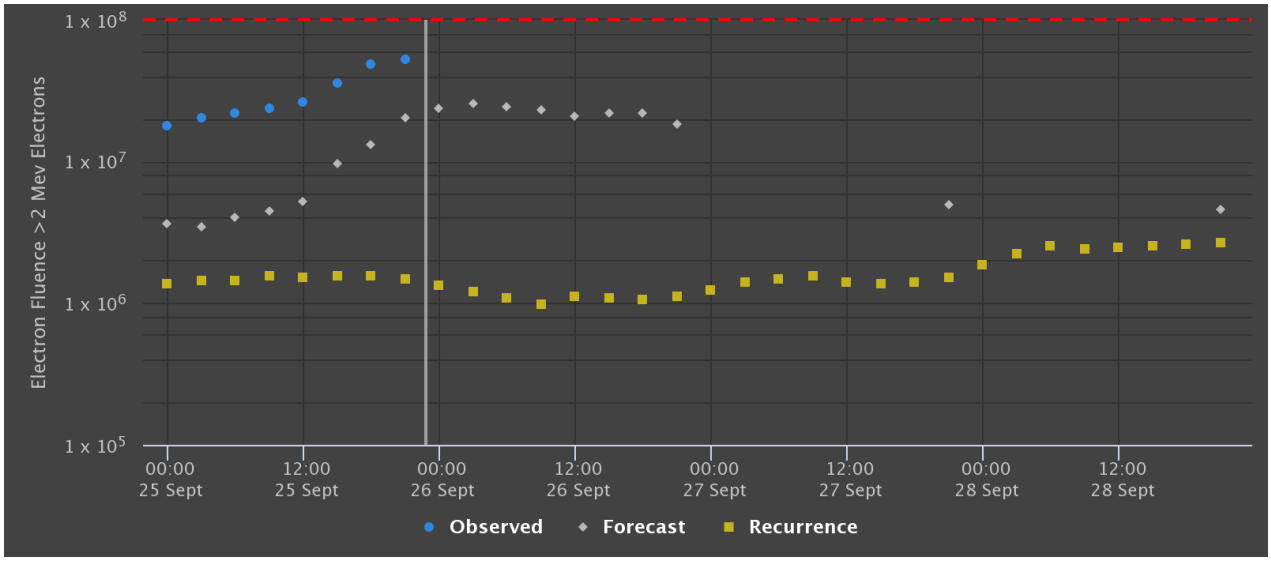
Figure 4: REFM Electron Fluence – observations, Forecast and Recurrance



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